

REMOTE KEY TURNING TOOL AND METHOD FOR USING THE SAME

Related Application(s)

The present application is a continuation of and claims priority from U.S. Patent Application Serial No. 10/301,216, filed November 21, 2002.

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Field of the Invention

The present invention relates to tools and, more particularly, to a tool for remotely turning a key.

Background of the Invention

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When servicing automobiles and the like, it is often necessary or desirable to turn the ignition switch of the automobile, via the ignition key, to and between the "on", "off" or "start" positions. In particular, a mechanic may wish to change the position of the ignition switch while located remotely from the ignition switch, for example, under the automobile or in or adjacent the engine bay of the

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automobile. Frequently, a second person is not available to operate the ignition switch or it is inconvenient or impractical for even a second person to operate the switch (e.g., the automobile is raised on a lift). Thus, the mechanic must move back and forth between the ignition switch and the area of the automobile to be serviced or observed.

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Summary of the Invention

According to embodiments of the present invention, a tool for remotely turning a key includes a key unit including an engagement assembly adapted to engage the key and an operator unit including a control assembly. At least one
5 cable segment is provided linking the key unit and the operator unit such that the engagement assembly can be mechanically rotated via the cable segment by manipulation of the control assembly to thereby rotate the key when the key is engaged by the engagement assembly.

The cable segment may be pulled when the control member is operated to
10 rotate the engagement assembly.

The key unit includes a key unit housing, the engagement assembly being rotatably mounted in the key unit housing. The operator unit includes an operator unit housing, the control assembly being mounted in the operator unit housing.

A clutch mechanism may be adapted to limit the load applied to the key by
15 the tool.

According to method embodiments of the present invention, a method for remotely turning a key includes providing a tool including a key unit including an engagement assembly adapted to engage the key. An operator unit including a control assembly is also provided. At least one cable segment is provided linking
20 the key unit and the operator unit such that the engagement assembly can be mechanically rotated via the cable segment by manipulation of the control assembly. The engagement assembly is mounted on the key, and thereafter the key is turned by manipulating the control assembly to mechanically rotate the engagement assembly via the cable segment.

25 Objects of the present invention will be appreciated by those of ordinary skill in the art from a reading of the figures and the detailed description of the preferred embodiments which follow, such description being merely illustrative of the present invention.

Brief Description of the Drawings

30 **Figure 1** is a perspective, fragmentary view of a remote key turning tool according to embodiments of the present invention;

Figure 2 is a perspective view of an operator using the tool of **Figure 1** to control the ignition switch of an automobile on a lift;

Figure 3 is an elevational, fragmentary view of a key unit of the tool of **Figure 1** mounted on an ignition key, the key being mounted in an ignition assembly of the automobile of **Figure 2**;

Figure 4 is a cross-sectional view of the key unit of **Figure 3** taken along the line 4-4 of **Figure 1** and mounted on the key;

Figure 5 is a rear, plan, fragmentary view of the key unit with portions thereof removed or sectioned for clarity;

Figure 6 is a cross-sectional view of an operator unit of the tool of **Figure 1** taken along the line 6-6 of **Figure 1**; and

Figure 7 is a front, plan, fragmentary view of the operator unit with portions thereof removed or sectioned for clarity.

Detailed Description of the Preferred Embodiments

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the relative sizes of regions may be exaggerated for clarity.

With reference to **Figures 1 and 2**, a remote key turning tool **10** according to embodiments of the present invention is shown therein. The tool **10** includes a key unit **100**, an operator unit **200**, and a cable system **12**. The cable system **12** includes a cable assembly **30** and a cable assembly **40**. The key unit **100** includes an engagement assembly **101** adapted to engage and turn an automobile key **8** (**Figure 3**) or the like. The operator unit **200** includes a control assembly **201** which can be manipulated (via a knob **268**) by an operator **4** to rotate the engagement assembly **101**. The engagement assembly **101** and the control assembly **201** are operably linked or connected by the cable assemblies **30, 40**.

Referring to **Figures 2 and 3**, an exemplary use for the tool **10** is shown therein. An automobile **2** is raised on a lift **3**. The key unit **100** is engaged with the key **8** of the ignition assembly **6** of the automobile **2**. The operator **4** is holding the operator unit **200** below the automobile **2** and the cable system **12** extends
5 through the window of the automobile **2**. In this manner, the operator **4**, while servicing or observing the underside of the automobile **2** (e.g., to repair or diagnose an undermounted fuel pump), may turn the ignition assembly **6** to the "on", "off" or "start" positions as needed.

Turning to the key unit **100** in greater detail and with reference to **Figures 3-5**, the key unit **100** includes a housing **102**. The housing **102** has housing parts **110** and **120** (housing part **110** is omitted from **Figure 5**). The housing **102** is preferably sized and shaped such that it can be conveniently and effectively handheld. Preferably, the housing **102** is no more than twelve inches long. The housing parts **110** and **120** are joined by screws **5** (**Figure 1**). An opening **112**
10 (**Figures 1 and 4**) is formed in the housing part **110**. An opening **122** (**Figure 4**), a bore **124** (**Figures 4 and 5**) and a pair of channels **130**, **132** (**Figures 4 and 5**) are formed in the housing part **120**. The channels **130**, **132** communicate with the bore **124** and respective end openings **130B**, **132B**. The channels **130**, **132** have respective enlarged portions **130A**, **132A** adjacent the openings **130B**, **132B**. The
15 housing parts **110**, **120** may be formed of any suitable material, and are preferably formed of metal, more preferably aluminum.

An optional counterweight/handle rod **104** extends from the housing **104**. The counterweight/handle rod **104** may be formed of any suitable material such as steel or lead.

25 The engagement assembly **101** includes a head member **140** (not shown in **Figure 5**) extending through the opening **122** and a base member **160** extending through the opening **112** and into the bore **124**. The base member **160** includes a cylindrical shaft portion **163**. The members **140** and **160** are joined by screws **5** (only one of which is shown in **Figure 4**). The members **140**, **160** are preferably
30 formed of metal, more preferably aluminum.

A bearing assembly **150**, preferably a ball bearing assembly as shown, is mounted in the bore **124**. The bearing assembly **150** includes an outer race **154** fixedly mounted with respect to the housing part **120** by a circlip **156**, which is

received in a groove 126 in the housing part 120. Balls 153 are captured between the outer race 154 and the inner, rotatable race 152. The head member 140 and the base member 160 are secured (e.g., via friction fit, adhesive, welding or suitable fastener(s)) to the inner race 152 for rotation therewith.

5 The head member 140 has a slot 142 defined therein and adapted to receive the key 8. The head member 140 also defines a passage 144 communicating with the slot 142 as well as a passage 164 defined in the base member 160. A pair of clamp arms 170 extend through the passages 144, 164. Each clamp arm 170 has a jaw portion 172 and a lever portion 174 and is pivotable with respect to the head
10 member 140 about a respective pivot pin 176. A spring 178 biases the jaws 172 into a closed (i.e., converged) position to securely grip the key 8. The jaws 172 can be opened to receive or release the key 8 by pressing the lever portions 174 toward one another. Alternatively or additionally, set screws 141 extending laterally through the head member 140 may be screwed into the slot 142 to grasp
15 the key 8. The head member 140, clamp arms 170, pivot pins 176, spring 178, and set screws 141 are removed from the unit 100 in Figure 5 for clarity.

Turning to the operator unit 200 in more detail and with reference to Figures 1, 6 and 7, the operator unit 200 includes a housing 202 (Figure 1). The housing 202 includes housing parts 210 and 220. The housing 202 is preferably
20 sized and shaped such that it can be conveniently and effectively handheld. Preferably, the housing 202 is no more than twelve inches long. The housing parts 210 and 220 are joined by screws 5 (Figure 1). An opening 212 (Figure 6) is formed in the housing part 210. An opening 222 (Figure 6), a bore 224 (Figures 6 and 7), and a pair of channels 230, 232 (Figures 6 and 7) are formed in the housing
25 part 220. The channels 230, 232 communicate with the bore 224 and respective end openings 230B, 232B. The channels 230, 232 have respective enlarged portions 230A, 232A adjacent the openings 230B, 232B. The housing parts 210, 220 may be formed of the same suitable and preferred materials as described above with regard to the housing parts 110, 120.

30 The control assembly 201 includes a base member 240 extending through the opening 222 and a face member 260 extending through the opening 212 and into the bore 224. The face member 260 includes a cylindrical shaft portion 243. The members 240, 260 are joined by screws (only one shown in Figure 6). The

members **240**, **260** are preferably formed of metal, more preferably aluminum. The face member **260** and the knob **268** are removed from the unit **200** in **Figure 6** for clarity.

5 A bearing assembly **250**, preferably corresponding to the bearing assembly **150**, is mounted in the bore **224**. The outer race **254** is fixedly mounted with respect to the housing part **220** by a circlip **256** which is received in a groove **226** in the housing part **220**. The balls **253** are captured between the outer race **254** and the inner, rotatable race **252**. The base member **240** is secured (e.g., via friction fit, adhesive, welding or suitable fastener(s)) to the inner race **252** for rotation
10 therewith. The ergonomic knob **268** is affixed to the face member **260** by a screw **5** such that the knob **268**, the base member **240**, the face member **260** and the inner race **252** are rotatable as a unit relative to the housing **202**.

Turning to the cable system **12** in more detail and with reference to **Figures 5** and **7**, the cable assemblies **30**, **40** are preferably of multi-layer construction as
15 shown and described below. The cable assemblies **30**, **40** are sectioned in **Figures 5** and **7** for the purpose of explanation. One or more bands **76** (**Figure 1**) may be provided to hold the cable assemblies **30**, **40** together. The cable assembly **30** includes a cable segment **32**, a spacer sheath **34** and a cover sheath **36**. The cable segment **32**, the sheath **34** and the sheath **36** are each flexible. The cable segment
20 **32** is preferably formed of multiple, twisted metal wires, but may be formed of any suitable material and construction (e.g., string). Preferably, the spacer sheath **34** defines a passage through which the cable segment **32** can freely slide. Preferably, the passage of the spacer sheath **34** is radially rigid to prevent or resist collapse of the passage. The spacer sheath **34**, while being laterally flexible, is preferably
25 substantially longitudinally fixed or incompressible. Preferably, the spacer sheath is formed of a wound metal wire. Preferably, the spacer sheath **34** has a length of at least 5 feet, more preferably of between about 8 and 16 feet, and most preferably of between about 10 and 11 feet. The cover sheath **36** is preferably formed of a flexible polymeric material, more preferably a plastic or rubber covering, to protect
30 surfaces (e.g., the automobile) from damage. The cable assembly **40** includes a cable segment **42**, a spacer sheath **44** and a cover sheath **46** corresponding to the cable segment **32**, the sheath **34** and the sheath **36**, respectively.

The cable segments 32 and 42 extend through the openings 130B and 132B and the channels 130 and 132, respectively, of the key unit 100 as shown in Figure 5. A cable loop segment 50 connects the cable segments 32, 42 to one another.

5 The cable loop segment 50 includes a plurality of loops 52 as shown in Figure 4 wound or helically wrapped about the shaft portion 163. Preferably, as discussed below, the loops 52 are not fastened to the shaft portion 163 or the engagement assembly 101.

10 Rigid grommets 70 are provided having reduced portions 70A mounted in the enlarged channel portions 130A, 132A of the housing part 120. Enlarged portions 70B receive the ends 34A, 44A of the spacer sheaths 34, 44 as well as the cable segments 32, 42. In this manner, the sheaths 34, 44 are braced against the housing 102.

15 The cable assemblies 30, 40 are similarly connected to the operator unit 200. More particularly, the cable segments 32, 42 extend through the grommets 70 (which also receive the remaining ends 34A, 44A of the spacer sheaths 34, 44 to thereby brace the sheaths 34, 44 against the housing 202) and through the channels 230 and 232, respectively. A cable loop segment 60 joins the cable segments 32, 42 and includes a plurality of loops 62 as shown in Figure 6. One of the loops 62 is fixedly captured between a screw 243 and a spacer 7 in a recess 242B of the base member 240.

20 An in-line spring 82 is positioned in the cable segment 42 in the channel 232 such that, when a prescribed tension in the cable segment 42 is exceeded, the spring 82 will stretch. The spring is preferably selected such that it is partially stretched to maintain a moderate tension in the cable segment 42 during normal operation. A clip or limiting wire loop (e.g., of wire or the like) 84 extends through and about the spring 82 to limit the ultimate extension of the spring 82.

25 The cable system 12 operatively connects the engagement assembly 101 and the control assembly 201 as follows. When the knob 268 and thus the member 240 are rotated in a clockwise direction A (Figure 7) relative to the housing 202, a portion of the cable segment 32 is pulled into the housing 202. The spacer sheath 34 serves as a spacer between the housings 102 and 202 so that the cable segment 32 is correspondingly pulled out of the housing 102. As a result, the cable segment 32, via the frictional engagement between the loop segment 50 and the shaft

portion 163, rotates the member 140 in a clockwise direction B (Figure 5) relative to the housing 102. Likewise, rotation of the knob 268 in a counterclockwise direction C (Figure 7) relative to the housing 202 pulls the cable segment 42 into the housing 202 and out of the housing 102, thereby rotating the member 160 in a counterclockwise direction D (Figure 5) relative to the housing 102. In addition to the pulling forces, the rotation of the member 160 may be enabled or facilitated by the pushing of the other cable segment 32 or 42.

Preferably, and as shown, the cable segments 32, 42, 50 and 60 each form a part of a continuous common cable 12A (Figures 5 and 7). It will be appreciated from the foregoing description that, while the cable segments 32, 42 and the cable loop segments 50, 60 are identified in the described and illustrated embodiments, they translate or shift from one category to another as the tool 10 is operated. That is, as the knob 268 is rotated in the direction A, a portion of the loop segment 60 will become part of the cable segment 30, a portion of the cable segment 32 will become part of the loop segment 50, a portion of the loop segment 50 will become part of the cable segment 42, and a portion of the cable segment 42 will become part of the loop segment 60. When the knob 268 is rotated in the opposite direction, the reverse shifting will occur. The cable 12A may be continuously formed or may include a plurality of separate cable segments joined (e.g., by splicing, clamping, welding or the like) to form a continuous, fabricated cable.

The loop segment 50 and the shaft portion 163 may cooperate to serve as a clutch or torque transfer limiting mechanism. That is, because the loop segment 50 is not fastened to the engagement assembly 101, up to a certain tension in either cable segment 32, 42 the loop segment 50 will grip or frictionally hold the shaft portion 163 to exert rotational force on the engagement assembly 101. However, once a prescribed rotational force is exceeded, the loop segment 50 will slip relative to the shaft portion 163, thereby effectively preventing a deliberate or inadvertent excessive rotational force or cable tension that may damage the key 8, the automobile 2, or the tool 10.

The tool 10 may be used by mounting the key unit 100 on the key 8 as discussed above and as illustrated in Figure 3, for example. The cable system 12 is routed to a remote location. The operator may then rotate the key 8 in either direction in the manner described above by rotating the knob 268 in the

corresponding direction relative to the housing 202. The weight of the non-rotated parts of the key unit 101 (i.e., the portions of the key unit 101 other than engagement assembly 101) counteract the rotation of the engagement assembly 101 so that the rotational driving force of the engagement assembly 101 is directed to the key 8. Preferably, the key unit (including the counterweight 104) other than the engagement assembly 101 weighs at least 0.75 pound, more preferably at least 1.25 pounds, and most preferably between about 1.5 and 2.5 pounds. The counterweight/handle rod 104 (Figure 1) may be used to stabilize the unit 100. A magnet 204 may be affixed to the housing 202 for temporarily securing the unit 200 to a suitable metal surface or object (e.g., automobile hood or underside, lift, etc.).

The tool 10 may provide a number of advantages. The tool 10 is simple and convenient to use. Because rotation in each direction is effected by pulling one of the cable segments 32, 42, the tool 10 may allow precise and sensitive control of the key 8. The tool 10 may provide high durability. The cable assemblies 30, 40 may be of substantially any suitable length while nonetheless maintaining consistent and positive control.

The tool 10 may be further provided with cable tension adjustment means. For example, the grommets 70 may be threaded into the housing parts 102, 202 such that the distance between the housings 120, 220 can be adjusted by screwing the grommets 70 in or out.

The tool 10 may be further provided with an electrical jumper extending from the key unit 100 to the operator unit 200. The key unit 100 may include an electrical connector adapted to engage an automobile cigarette lighter socket or other power connector, for example, thereby allowing the operator to source or test the power provided at the socket.

Other structures or components to grasp the key 8 with the engagement assembly 101 may be provided. Moreover, the head member 140 and other portions of the engagement assembly 101 may be adapted to be removed and replaced with such other components. For example, the head member 140 may be interchangeable such that it can be replaced with a replacement head member that is differently configured. The replacement head member may be adapted to hold

the key 8 in a different manner and/or may be adapted to grasp a key of a different configuration and/or size than the key 8.

5 The tool 10 may be modified to eliminate one or both of the cable loop segments 50, 60. For example, the ends of the cable segments 32, 42 may be anchored (e.g., with fasteners, welds, or adhesive) to the shaft portions 163, 243 such that the cable segments are pushed or pulled in the manner described above as the assemblies 101, 201 are rotated.

The control assembly 201 may be replaced with other components to pull the cable segments 32, 42, such as a lever and pulleys suitably arranged.

10 The cable 12A may be replaced with multiple, separate cables. "Cable segment" as used herein does not require that the cable including the cable segment include any further cable portion or segment. That is, the referenced cable segment may constitute the entirety of a cable.

15 The control assembly 101 and the engagement assembly 201 as discussed above each include multiple, joined components. However, the assemblies 101, 201 may each be formed of fewer components and may even be unitarily formed in accordance with embodiments of the present invention. "Control assembly" and "engagement assembly" as used herein are intended to include all such embodiments.

20 The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly,
25 all such modifications are intended to be included within the scope of this invention. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the invention.